REMARKS

Claims 1-48 are pending in the application. Of these claims, claims 15-20, 22, 23 and 30-33 are withdrawn from consideration. Claim 8 is cancelled. Claims 10 and 21 were previously cancelled. Claims 34-48 are newly added.

Claims 1, 4 and 11-14 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,109,293 to Matsunaga et al., hereinafter "Matsunaga". Claim 1 is independent. Claims 11-14 are independent by virtue of the present amendment. Applicants respectfully traverse this rejection.

Claim 1 provides a liquid crystal device including a first cell wall and a second cell wall enclosing a layer of liquid crystal material, electrodes for applying an electric field across at least some of the liquid crystal material, and a surface alignment structure on the inner surface of at least the first cell wall providing a single desired alignment to a liquid crystal director. The surface alignment structure includes a two dimensional array of alignment posts which are formed from a photoresist material or a plastics material, and which are shaped and oriented to produce the desired alignment.

Matsunaga discloses a ferroelectric liquid crystal display (LCD) element including a pair of substrates having transparent electrodes, and alignment layers formed on opposing surfaces of the pair of substrates which are inclined with respect to a substrate surface and have opposite inclination directions (col. 1, lines 58-63). Each inner surface has an oblique alignment layer formed by the well-known technique of oblique vapour deposition of SiO (col. 1, lines 33-42). A liquid crystal is injected in a direction opposite to an inclination direction of small columns forming the alignment layers (col. 1, line 67 – col. 2, line 2). "[I]t is considered that the aligning direction is approximate to an average of the directions of all liquid crystal molecules 23 attached to the small SiO columns 22 . . ." (col. 2, lines 28-31) The oblique alignment layers of Matsunaga are formed by oblique evaporation of SiO, or alternatively of Al_2O_3 or MgF_2 (col. 3 line 31).

Matsunaga discloses an LCD element that includes small SiO columns, or alternatively columns made of Al_2O_3 or MgF_2. However, the materials disclosed in Matsunaga are inorganic (mineral) materials which are not a photoresist or a plastics material. Thus, Matsunaga does not disclose "alignment posts which are formed from a material selected from the group consisting of a **photoresist material** and a **plastics material**," as recited in claim 1. Therefore, claim 1 is not anticipated by Matsunaga.

Claim 4 depends from claim 1. For at least reasoning similar to that provided in support of claim 1, claim 4 is patentable over Matsunaga.

Independent claims 11-14 recite features similar to those recited in claim 1. For at least reasoning similar to that provided in support of claim 1, claims 11-14 are patentable over Matsunaga. Claims 12-14 have been amended to remove any reference to other claims, and to clarify that they are method claims.

For the reasons set forth above, the rejection of claims 1, 4 and 11-14 under 35 U.S.C. 102(b) as anticipated by Matsunaga is overcome. Applicants respectfully request that the rejection of claims 1, 4 and 11-14 be reconsidered and withdrawn.

Claims 1, 2, 4, 9, 11-14 and 24-29 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,519,018 to Samant et al., hereinafter "Samant". Claim 1 is independent. Claims 11-14 are independent by virtue of the present amendment. Applicants respectfully traverse this rejection.

Claim 1 provides a liquid crystal device including a first cell wall and a second cell wall enclosing a layer of liquid crystal material, electrodes for applying an electric field across at least some of the liquid crystal material, and a surface alignment structure on the inner surface of at least the first cell wall providing a single desired alignment to a liquid crystal director. The surface alignment structure includes a two dimensional array of alignment posts which are formed from a photoresist material or a plastics material, and which are shaped and oriented to produce the desired alignment.

Samant discloses homeotropic liquid crystal (LC) displays, including alignment structures on a planar substrate which locally align the LC vertical to the planar substrate (col. 2, lines 43-47). The alignment structure is generally made up of at least one or a plurality of walls or pillars rising from the surface of a planar substrate layer (col. 2, lines 47-50). At least one surface of the wall(s) or pillar(s) has bond anisotropy sufficient such that liquid crystal molecules adjacent to the surface are aligned along the vertical surface of the wall or pillar, i.e. vertically to the planar substrate (col. 2, lines 50-54).

Samant discloses homeotropic alignment of LC by walls or pillars which are of sufficient height to act as a spacer between the cell walls. The walls or pillars must be of a material in which bond anisotropy can be induced by ion bombardment (col. 5, lines 21-24). At least a portion of the surface of the walls has bond anisotropy that is sufficient to align liquid crystal molecules vertical to the floor of the cell in which the wall is found, i.e. vertically to the substrate layer. Bond anisotropy is defined in that bonds on the surface of the wall are aligned in one direction such that liquid crystal molecules adjacent to the surface align in the direction of the bonds (col. 5, lines 42-50). At least a portion of the surface of the walls or pillars are bombarded with ions (col. 7, lines 11-12). The ion beam on the wall surface influences the pre-tilt of the LC molecules (col. 7, lines 37-38).

Thus, the desired homeotropic alignment is produced by the use of ion bombardment to induce bond anisotropy. The alignment is not produced by **the shape and orientation** of the alignment structures as recited in claim 1.

Ion-beam bombardment was developed as a substitute for mechanical rubbing of polyimide film as a noncontact LC alignment technique. This is explained in more detail in the enclosed article: Lien et al., "Active-matrix display using ion-beam-processed polyimide film for liquid crystal alignment", IBM Journal of Research and Development, Vol. 42, Nos. ¾, 1998. By ion-bombarding a surface, LC molecules can be induced to

align parallel to that surface. By making the surface vertical, LC molecules align parallel to the vertical surface, i.e., perpendicular to the plane of the cell walls. This is achieved independently of the shape of the aligning surface: an ion-bombarded vertical wall will also cause LC molecules to align parallel to a vertical surface. Thus, the **shape** of the alignment surface **does not** affect the alignment in Samant. In contrast to Samant, claim 1 provides a liquid crystal device having a two-dimensional array of posts which are both **shaped and oriented** to produce the desired alignment.

Samant does not disclose or suggest a liquid crystal device that "comprises a two dimensional array of alignment posts which are formed from a material selected from the group consisting of a photoresist material and a plastics material, and which are **shaped and oriented** to produce the desired alignment," as recited in claim 1. Therefore, Samant does not disclose or suggest the features of claim 1. Thus, claim 1 is patentable over Samant.

Claims 2, 4, 9 and 24-29 depend from claim 1. For at least reasoning similar to that provided in support of claim 1, claims 2, 4, 9 and 24-29 are patentable over Samant.

Independent claims 11-14 recite features similar to those recited in claim 1. For at least reasoning similar to that provided in support of claim 1, claims 11-14 are patentable over Samant.

For the reasons set forth above, the rejection of claims 1, 2, 4, 9, 11-14 and 24-29 under 35 U.S.C. 102(b) as anticipated by Samant is overcome. Applicants respectfully request that the rejection of claims 1, 2, 4, 9, 11-14 and 24-29 be reconsidered and withdrawn.

Claims 2, 3, 5, 6 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsunaga in view of U.S. Patent No. 5,917,570 to Bryan-Brown et al., hereinafter "Bryan-Brown". Claims 2, 3, 5 and 6 depend from claim 1. Claim 8 is cancelled. Applicants respectfully traverse this rejection.

As discussed above, Matsunaga discloses an LCD element including small columns made of SiO, Al_2O_3 *or* MgF_2, but does not disclose "alignment posts which are formed from a material selected from the group consisting of a **photoresist material** and a **plastics material**," as recited in claim 1.

Bryan-Brown discloses a liquid crystal display cell including a bigrating structure on one or both cell walls by which the liquid crystal material is aligned (abstract). This grating structure is a bigrating with one symmetrical grating and an asymmetric grating which may be orthogonal to the symmetric grating (abstract). "The gratings may be formed of a photoresist material, or of a plastics material formed by embossing of eg polyolefin. The embossed material may also provide small pillars (eg or 1-3 μm height and 5-50 μm or more width) for assisting in correct spacing apart of the cell walls and also for a barrier to liquid crystal material flow when a cell is flexed. Alternatively the pillars may be formed by the material of the gratings." (col. 2, lines 36 – 43)

Bryan-Brown discloses small pillars for 1) assisting in **correct spacing** apart of the cell walls, and 2) for **a barrier** to liquid crystal material flow. However, Bryan-Brown does not disclose the pillars as being a surface alignment structure, as the pillars are not disclosed as having any ability to affect the alignment of the liquid crystal ("LC"). The LC is aligned in Bryan-Brown by use of a bigrating. It is clear from col. 2, lines 36-43 that the alignment bigrating and the pillars are two totally different elements, as has been discussed in previous responses. Thus, combining Bryan-Brown with Matsunaga would merely result in an SiO alignment layer with additional pillars for spacing and as a barrier to LC flow. This would not produce the liquid crystal device of claim 1, that provides **a two-dimensional array of alignment posts that are shaped and oriented to produce a desired alignment**.

Neither Matsunaga nor Bryan-Brown discloses or suggests a liquid crystal device including "a two dimensional array of alignment posts which are formed from a material selected from the group consisting of a photoresist material and a plastics material, and

which are shaped and oriented to produce the desired alignment," as recited in claim 1. Therefore, neither Matsunaga nor Bryan-Brown, whether considered alone or in combination, teaches or suggests the features of claim 1. Thus, claim 1 is patentable over the cited combination of Matsunaga and Bryan-Brown.

In addition, there is no motivation to combine the teachings of Matsunaga and Bryan-Brown. Also, combining the teachings of Bryan-Brown with Matsunaga would render the LCD element of Matsunaga unsatisfactory for its intended purpose. Furthermore, Matsunaga explicitly teaches away from the pillars of Bryan-Brown.

Matsunaga provides an epoxy resin seal for spacing glass substrates. Matsunaga does not disclose or imply any desirability of using additional structures for assisting in spacing. Specifically, Matsunaga does not teach or imply any desirability of using small pillars for assisting in spacing or as a barrier to liquid crystal flow, as disclosed in Bryan-Brown. Also, Bryan-Brown teaches that the problem of a limited range of pre-tilts is overcome "by varying the profile of the groove along its length whereby the pretilt can be arranged to have selected values" (col. 1, lines 65-67). Since the use of a groove of varying profile **alone** produces the appropriate range of pretilts, Bryan-Brown provides no suggestion or motivation to modify its disclosure by using the columns of Matsunaga. Any motivation to combine Bryan-Brown with Matsunaga is therefore provided by Applicants' own disclosure, not by the prior art. Thus, combination of the teaching of Matsunaga and Bryan-Brown is based on an impermissible hindsight reconstruction of Applicants' claims.

Also, the combination of Matsunaga and Bryan-Brown would render Matsunaga **unsuitable for its intended purpose**. The SiO alignment layers of Matsunaga are formed by evaporation of SiO at an oblique angle. This process is not controllable to form well-defined post structures, and certainly not to form pillars of 1-3 μm. Typical layer thicknesses for evaporated SiO are of the order of 200-300 Angstroms (20-30 nm) – as described in the enclosed J. Cognard, *Alignment of Liquid Crystals*, section III.2.3, p67. Thus, forming alignment posts in Matsunaga to a height of 1-3 μm, as suggested

in the Office Action, would result in the columns of Matsunaga being ill-formed and thus unsuitable for the purpose disclosed in Matsunaga.

Furthermore, Matsunaga **teaches away from** the cited combination of Matsunaga and Bryan-Brown. Bryan-Brown teaches small pillars for assisting in correct spacing apart of the cell walls and also for a **barrier to liquid crystal material flow**. As provided in column 4, lines 12-14, Matsunaga discloses that " liquid crystal is injected into the space between said substrates only in a direction opposite to the inclination direction of the oblique polymer layers." A barrier to LC flow would be expected to interfere with a directional LC injection and reduce the uniform alignment which Matsunaga purports to achieve. Matsunaga thus clearly teaches away from Bryan-Brown and the present invention.

The cited combination of Matsunaga and Bryan-Brown does not disclose or suggest the elements of claim 1. Also, there is no motivation to combine the teachings of Matsunaga and Bryan-Brown. Thus, claim 1 is patentable over the cited combination of Matsunaga and Bryan-Brown.

Claims 2, 3, 5 and 6 depend from claim 1. For at least reasoning similar to that provided in support of claim 1, claims 2, 3, 5 and 6 are patentable over the cited combination of Matsunaga and Bryan-Brown.

For the reasons set forth above, the rejection of claims 2, 3, 5, 6 and 8 under 35 U.S.C. 103(a) as unpatentable over Matsunaga in view of Bryan-Brown is overcome. Applicants respectfully request that the rejection of claims 2, 3, 5, 6 and 8 be reconsidered and withdrawn.

Claims 3, 5, 6 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Samant in view of Bryan-Brown. Claims 3, 5 and 6 depend from claim 1. Claim 8 is cancelled. Applicants respectfully traverse this rejection.

As discussed above, Samant does not disclose or suggest a liquid crystal device having "a two dimensional array of alignment posts . . . which are **shaped and oriented to produce the desired alignment**," as recited in claim 1.

As also discussed above, Bryan-Brown discloses a liquid crystal display cell that may include small pillars for assisting in correct spacing apart of the cell walls and also for a barrier to liquid crystal material flow when a cell is flexed. The pillars of Bryan-Brown have no effect on alignment of the liquid crystals. Thus, Bryan-Brown also does not disclose or suggest "a two dimensional array of alignment posts . . . which are **shaped and oriented to produce the desired alignment**," as recited in claim 1.

Neither Samant nor Bryan-Brown disclose or suggest "a two dimensional array of alignment posts . . . which are **shaped and oriented to produce the desired alignment**," as recited in claim 1. Thus, neither Samant nor Bryan-Brown, whether considered alone or in combination, discloses or suggests the features of claim 1. Therefore, claim 1 is patentable over the cited combination of Samant and Bryan-Brown.

Claims 3, 5, 6 and 8 depend from claim 1. For at least reasoning similar to that provided in support of claim 1, claims 3, 5, 6 and 8 are patentable over the cited combination of Samant and Bryan-Brown.

For the reasons set forth above, the rejection of claims 3, 5, 6 and 8 under 35 U.S.C. 103(a) as unpatentable over Samant in view of Bryan-Brown is overcome. Applicants respectfully request that the rejection of claims 3, 5, 6 and 8 be reconsidered and withdrawn.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Matsunaga in view of Japanese Patent No. 5-249463, hereinafter "JP'463". Claim 7 depends from claim 1. Applicants respectfully traverse this rejection.

Claim 1 provides a liquid crystal device including a first cell wall and a second cell wall enclosing a layer of liquid crystal material, electrodes for applying an electric field across at least some of the liquid crystal material, and a surface alignment structure on the inner surface of at least the first cell wall providing a single desired alignment to a liquid crystal director. The surface alignment structure includes a two dimensional array of alignment posts which are formed from a photoresist material or a plastics material, and which are shaped and oriented to produce the desired alignment.

As discussed above, Matsunaga discloses an LCD element including small columns made of SiO, Al_2O_3 *or* MgF_2, but does not disclose "alignment posts which are formed from a material selected from the group consisting of a **photoresist material** and a **plastics material**," as recited in claim 1.

JP'463 discloses surfactants for use as layers on oriented films or adding surfactant into a liquid crystal. However, JP'463 does not disclose a liquid crystal device including a surface alignment structure, or a surface alignment structure having "a two dimensional array of alignment posts which are formed from a material selected from the group consisting of a photoresist material and a plastics material, and which are shaped and oriented to produce the desired alignment," as recited in claim 1.

Neither Matsunaga nor JP'463 disclose or suggest a liquid crystal device including a surface alignment structure that "comprises a two dimensional array of alignment posts which are formed from a material selected from the group consisting of a photoresist material and a plastics material, and which are shaped and oriented to produce the desired alignment," as recited in claim 1. Therefore, neither Matsunaga nor JP'463, whether considered alone or in combination, discloses or suggests the elements of claim 1. Thus, claim 1 is patentable over the cited combination of Matsunaga and JP'463.

Claim 7 depends from claim 1. For at least reasoning similar to that provided in support of claim 1, claim 7 is patentable over the cited combination of Matsunaga and JP'463.

For the reasons set forth above, the rejection of claim 7 under 35 U.S.C. 103(a) as unpatentable over Matsunaga in view of JP'463 is overcome. Applicants respectfully request that the rejection of claim 7 be reconsidered and withdrawn.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Samant in view of JP'463. Claim 7 depends from claim 1. Applicants respectfully traverse this rejection.

As discussed above, Samant does not disclose or suggest a liquid crystal device having "a two dimensional array of alignment posts . . . which are **shaped and oriented to produce the desired alignment**," as recited in claim 1. Also as discussed above, JP'463 does not disclose a liquid crystal device including a surface alignment structure, or a surface alignment structure having "a two dimensional array of alignment posts," as recited in claim 1.

Neither Samant nor JP'463 discloses or suggests a liquid crystal device including a surface alignment structure that "comprises a two dimensional array of alignment posts which are formed from a material selected from the group consisting of a photoresist material and a plastics material, and which are shaped and oriented to produce the desired alignment," as recited in claim 1. Therefore, neither Samant nor JP'463, whether considered alone or in combination, discloses or suggests the elements of claim 1. Thus, claim 1 is patentable over the cited combination of Samant and JP'463.

Claim 7 depends from claim 1. For at least reasoning similar to that provided in support of claim 1, claim 7 is patentable over the cited combination of Samant and JP'463.

For the reasons set forth above, the rejection of claim 7 under 35 U.S.C. 103(a) as unpatentable over Samant in view of JP'463 is overcome. Applicants respectfully request that the rejection of claim 7 be reconsidered and withdrawn.

Claims 9 and 24-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsunaga in view of Samant. Claims 9 and 24-29 depend from claim 1. Applicants respectfully traverse this rejection.

As discussed above, neither Matsunaga nor Samant discloses a liquid crystal device that "comprises a two dimensional array of alignment posts which are formed from a material selected from the group consisting of a photoresist material and a plastics material, and which are shaped and oriented to produce the desired alignment," as recited in claim 1. Therefore, claim 1 is patentable over the cited combination of Matsunaga and Samant. Claims 9 and 24-29 depend from claim 1. For at least reasoning similar to that provided in support of claim 1, claims 9 and 24-29 are patentable over the cited combination of Matsunaga and Samant.

For the reasons set forth above, the rejection of claims 9 and 24-29 under 35 U.S.C. 103(a) as unpatentable over Matsunaga in view of Samant is overcome. Applicants respectfully request that the rejection of claims 9 and 24-29 be reconsidered and withdrawn.

New independent claims 34 and 48 are provided to clarify features of the invention. Applicants respectfully submit that claims 34 and 48, and their independent claims, are patentable over the references discussed above.

An indication of the allowability of all pending claims by issuance of a Notice of Allowability is earnestly solicited.

Respectfully submitted,

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